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SCIENCE AND THE ACCELERATION OF TECHNICAL PROGRESS

by

Author Unknown

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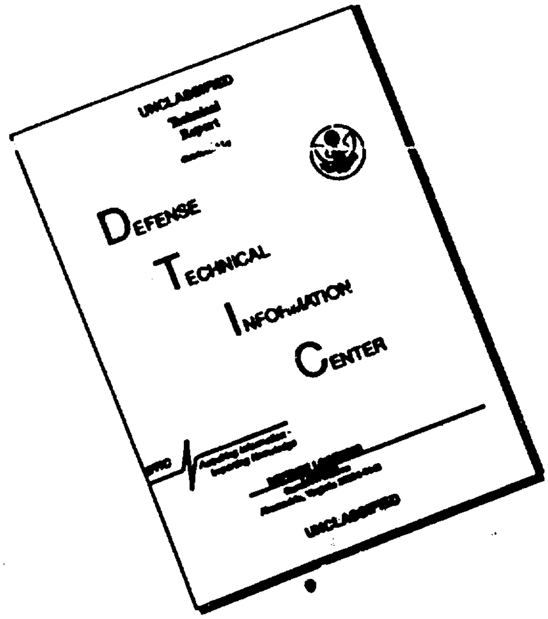

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SCIENCE AND THE ACCELERATION OF TECHNICAL PROGRESS

Author Unknown

A ~~single~~ question was put ~~by the editors of [illegible]~~ to a group of physicists from a number of different cities in the country: "What, in your opinion, should be done to increase the contribution of Soviet science to accelerated scientific and technical progress?" The replies of the participants of this informal round table are given ~~below~~.

The Scope of Research

I. N. Frantsevich, Director of the Institute of Problems of the Science of Materials, Member of the Academy of Sciences of the Ukrainian SSR. "The primary stimulus to scientific and technical progress is to be found the kind of long-range fundamental scientific research, the practical significance of which may at first not appear particularly evident. Let us cite a typical example. About forty years ago the dislocation theory was developed. The prevailing view, during the initial stages of its refinement, held that it was extremely unlikely that this theory would ever contribute significantly to a solution of the essential problems of materials science. In fact, the very existence of the dislocation itself was regarded with considerable scepticism. Today this theory is at the very heart of solutions to a wide range of practical tasks.

"No less important is the ability to guide successful concrete ideas through to their large-scale practical implementation. An

instructive example of this kind of follow-through can be seen in the work of the outstanding Ukrainian scientist Ye. O. Paton and his associates in their development of the automatic flux welding method into a full-fledged scientific methodology.

"The departmental breakdown of work projects into the twin categories of long-term and applied-engineering ought not to be absolutized. It is not administrative association with a particular branch or department, but personnel that is the determining factor in an organization's creativity. It is very important that, wherever expedient, every institute have the resources to see its theoretical scientific developments through to practical fruition. To this end it is necessary, in our opinion, that organizations involved in scientific research be able to call upon well equipped design offices, prototype production facilities, and – if its staff is working on some radically new technical innovation – an adequate team of instructors capable of giving on-the-spot production assistance at plants and factories.

"The main thing, in our view, is that the theoretical as well as the practical people become as involved as possible and play a more active role in the solution of these engineering and physical problems."

Avoid Lost Time

V. M. Tuchkevich, Director of the Physical-Technical Institute, Corresponding Member of the Soviet Academy of Sciences. "According to our system, the implementation of any new scientific idea passes through a number of successive stages: the laboratory – the branch institute – the plant. And quite often the idea runs into obstacles at each stage.

"If the concept originated in the laboratory of an academic institute or vuz (*Translator's Note:* vuz - *higher institute of learning*), it is by no means always possible to demonstrate its appropriateness or practical feasibility in a reasonably short time. This is because not every laboratory has the equipment necessary to this end.

"Regarding the second stage, at the branch NII (*Translator's Note: NII - Scientific Research Institute*), it may happen that the technical people there aren't interested in developing an 'outside-originated' idea. Often it is a matter of months before both sides can reach an agreement on all aspects of the technology and design.

"Finally, there is the terminal stage, the plant. Here, based on the equipment and tooling presently available at the plant, the engineering staff will occasionally revise the technology and, in some cases, even the design. The result, still further delay.

"It does not follow that even series production of a new item necessarily means practical acceptance of that item. In fact, simply because it has been produced, a component or instrument does not automatically become useful to a customer if the equipment for which it has been designed is not yet in production. This was the case, to cite one example, of the high-power semiconductor tubes developed at our institute. For two years the plant manufacturing these tubes was working, you might say, for the 'shelf.' The situation changed only with the appearance of the rectifier units for electrolysis and electric trains. In a word, lack of coordination and guidance in the efforts of numerous research agencies, branch institutes, and production facilities poses a major obstacle to the practical implementation of many scientific achievements.

"It would appear that in many instances important national economic problems might best be solved by abandoning this step-by-step processing of new ideas. In our opinion, task forces might be set up, which would continue their work only until the completion of a specific project. These task forces should include representatives from all interested organizations and agencies, from the Academy of Sciences to the plant level.

"Quite instructive, in this regard, is the experience we gained in the development of the semiconductor current-frequency converter. To meet this task, we established a task force which included staff workers from our institute and from the Power Institute, along with plant-level technical personnel. The entire work, from the conceptual

stage to production of a pilot model, was accomplished in a very short time."

In Cooperation with Engineers

E. D. Andronikashvili, Director of the Institute of Physics, Member of the Academy of Sciences of the Georgian SSR. "The rate of scientific-technical progress is affected by a variety of factors. One of the principal deficiencies in many scientific establishments is insufficient attention to the development of new experimental methodologies for the discovery and analysis of natural phenomena.

"At our institute we developed spark chambers, of the streamer and wide-gap type, which are now used with all accelerators. Another kind of instrument was designed for work in the area of high-energy physics – a discharge-condensation chamber, capable of competing, in a number of applications, even with the familiar hydrogen bubble chamber. We have proposed original methods for studying the strength characteristics of metals and alloys at low temperatures and have built sensitivity microcalorimeters to permit the formulation and solution of utterly new problems in the area of biomacromolecular physics.

"Unfortunately, the instrument-manufacturing industry has shown little interest in the production of these new devices. To cite a specific case, our institute worked on the development of an apparatus which, based on the behavior of a radioactive signal throughout a production cycle, would signal the manganese concentration in the raw material, in the concentrates, and in the ferroalloys. What was the result? Far less time was required for the R&D phase of the project then for the introduction of a prototype model at one of the Chiatura concentrating mills.

"It often happens that the practical implementation of scientific developments is left to scientists who do not understand the production aspects of the problem, or to engineers who are not familiar with the principles underlying the new machine or equipment. We have already submitted a proposal to the effect that in such cases mixed teams of alternating membership should be formed, to include

scientific personnel and production-oriented engineers. As the work proceeds, the number of scientists in the group should decrease, while the number of production engineers, well acquainted with the prospective environmental conditions of the equipment under development increases. It is our belief that an approach of this kind would do much to meet the requirements of satisfactory scientific and technical progress."

From Department to Shop

I. N. Pustynskiy, Department Chairman of the Tomsk Institute of Radio Electronics and Electronic Engineering. "Here is a letter we recently received: 'In line with technical assistance procedures, we request that you send operating instructions for the PTU-8G "Teleglaz" industrial television system, as well as information regarding its cost, the manufacturing plant, and the enterprises at which it is presently in use.' The inquiry came to us from the Kuznetsk Metallurgical Combine.

"Our reply was a factual one. Portable television systems which can be used to view the inside of pipes and various containers do exist. The PTU-8G is one such system; the letter "G" in the designation stands for "gornaya" ["mining"] (*Translator's Note: The remaining letters "PTU" in the same designation are the initial letters of the Russian words for "portable television system"*). This 'Teleglaz' ['Tele-Eye'] can be inserted into a shaft 100 millimeters in diameter.

"This system (it was shown at the VDNKh (*Translator's Note: VDNKh - Exhibit of National Economic Achievements*)) was developed by us on an order from, and with the assistance of, the Institute of Mining of the Siberian Branch of the Soviet Academy of Sciences. Other similar devices have been used at aircraft factories, at chemical plants, and at the I. V. Kurchatov Atomic Energy Institute. This last 'Tele-Eye' of ours, the tenth of the series, is the smallest. Its pick-up camera is designed in the form of a metal cylinder 25 millimeters in diameter. The entire unit, with cable and remote receiver, will fit in a briefcase. It plugs into a normal power outlet and in the field is fed by a 12-volt storage battery.

"With regard to the second part of the question, about the manufacturing plant, thus far there is, regrettably, no manufacturing plant, although our own in-house production facilities are limited and unable to satisfy even the internal demand.

"What should be done? A system clearly delineating the various areas of responsibility should be set up; who is to propose new ideas, who is to carry out the research and development work, and who is to see to series production. All these activities must be subordinated to a single coordinated plan, with common incentives provided for everyone involved in the projected new item. And while in the case of the branch institutes these problems are solved in accordance with the economic reform program — as indicated by the experience of the electrotechnical industry — effective lines of communication must also be sought for vus-centered research organizations.

"Today, in our opinion, the process of bringing a new item from the vus laboratory into actual production must still involve an intermediate step — an organization or firm capable of assigning and remunerating the work at its various stages of completion. We consider the establishment of such financially self-sustaining firms to promote the purposes of scientific and technical progress to be a measure of great timeliness."

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13. ABSTRACT

The article discusses certain of the problems encountered in bringing a new technological concept to the practical hardware stage in the USSR. A number of management and administrational difficulties inherent in the existing chain-of-command structure are briefly discussed. Particular attention is called to the PTU-8G "Teleglaz" miniaturized television system (with a pick-up camera in the form of a metal cylinder 25 mm in diameter), which can be inserted into a shaft 100 mm in diameter for the inspection of the interior of pipes and containers. This unit is said to be the tenth of a series.

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